Wall Assembly Analysis

Winter design conditions (Zone 6A) Elk Rapids, MI

2015 IRC R402.1.1 Table N1102.1.1 (current)

g. The second *R*-value applies when more than $^1/_2$ the insulation is on the interior of the mass wall.

Minimum exterior continuous insulation: R-5 per table above

Dew Point analysis typical conservative model:

- **Indoor:**
  - 70°F
  - 35% RH → **dew point ≈ 40°F**
- **Outdoor:**
  - 0°F (cold winter design temp)

Condensation risk exists if the inside face of the sheathing drops below 40°F.

We calculate the temperature at that plane using R-value ratios.

Temperature drop to sheathing:

Option A – 3.5” Studs

Wall assembly (inside to outside)

Layer	**Approx. R-value**
Interior air film	R-0.68
1/2" gypsum board	R-0.45
3.5" batt insulation (typical)	**R-13.0 PASS**
ZIP System R-Sheathing **1.5**”	**R-6.6 PASS**
Exterior air film	R-0.17

Option B – 5.5” Studs

Wall assembly (inside to outside)

Layer	**Approx. R-**

	value
Interior air film	R-0.68
1/2" gypsum board	R-0.45
5.5" batt insulation (typical)	**R-20.0 PASS**
ZIP System R-Sheathing **1.5**”	**R-6.6 PASS**
Exterior air film	R-0.17

Option C – 5.5” Studs

Wall assembly (inside to outside)

Layer	**Approx. R-value**
Interior air film	R-0.68
1/2" gypsum board	R-0.45
5.5" batt insulation (typical)	**R-20.0 PASS**
Exterior air film	R-0.17

Option D – 5.5” Studs (recommendation)

Wall assembly (inside to outside)

Layer	**Approx. R-value**		
Interior air film	R-0.68		
1/2" gypsum board	R-0.45		
3.5" batt insulation (typical)	**R-13.0**		
2” ccSPF (closed cell foam)	**R-13.0 Vapor-tight + airtight interior layers**		
ZIP System R-Sheathing **1.5**”	**R-6.6 PASS**		
Exterior air film	R-0.17		

Option E – 5.5” Studs (recommendation)

Wall assembly (inside to outside)

Layer	Approx. R-value		
Interior air film	R-0.68		
1/2" gypsum board	R-0.45		
3.5" batt insulation (typical)	**R-13.0**		
1” ccSPF (closed cell foam)	**R-7.0 Vapor-tight + airtight interior layers - double check R value for 1"**		
Exterior air film	R-0.17		

Verdict: Best code-compliant assembly *and* best performance, but high upfront.

Hybrid (Spray Foam + Batt/Cellulose + ZIP)

- **Targeted spray foam:** Seal rim joists, band joists, window heads, and the upper interior edge — addresses most air leakage paths that batts completely fail at. Stops moisture from reaching the inside face of the ext. sheathing
- **Cellulose in the remainder** for cheap R-value and good damping of air movement within cavities.
- **ZIP or rigid CI on the exterior** gives you continuous insulation that easily hits **R-13 cavity + R-5 CI** or better.

2021 IRC R402.1.1 Table N1102.1.1

Minimum exterior continuous insulation: **R-7.5** per IRC R702.7

Dew Point analysis typical conservative model:

- **Indoor:**
  - 70°F

    - 35% RH → **dew point ≈ 40°F**
- **Outdoor:**
    - 0°F (cold winter design temp)

Condensation risk exists if the inside face of the sheathing drops below 40°F.

We calculate the temperature at that plane using R-value ratios.

Temperature drop to sheathing:

Option A – 3.5” Studs

Wall assembly (inside to outside)

Layer	**Approx. R-value**
Interior air film	R-0.68
1/2" gypsum board	R-0.45
3.5" batt insulation (typical)	**R-13.0**
ZIP System R-Sheathing **2**”	**R-9.6**
Exterior air film	R-0.17

Option B – 5.5” Studs

Wall assembly (inside to outside)

Layer	**Approx. R-value**
Interior air film	R-0.68
1/2" gypsum board	R-0.45
5.5" batt insulation (typical)	**R-20.0**
ZIP System R-Sheathing **1.5**”	**R-9.6**
Exterior air film	R-0.17

Option B – 5.5” Studs (recommendation)

Wall assembly (inside to outside)

Layer	**Approx. R-value**		
Interior air film	R-0.68		
1/2" gypsum board	R-0.45		
3.5" batt insulation (typical)	**R-13.0**		
2” ccSPF (closed cell foam)	**R-13.0 Vapor-tight + airtight interior layers**		
ZIP System R-Sheathing **2**”	**R-9.6**		
Exterior air film	R-0.17		

Wall Type	**Sheathing Temp**	**Dew Point Risk**	**Code Status**	**Notes**
2×4 batt	~29°F	⚠ Moderate	✔ Pass	Needs air sealing
2×6 batt	~22°F	❌ High	✔ Pass	Worst ratio
2×6 + 2" ccSPF	~19°F	✅ Low (controlled)	✔ Pass	Best real-world performance